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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
SINGH, RAMNANDAN P	

ART UNIT	PAPER NUMBER
2644	2

DATE MAILED: 06/09/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/987,046	KOSANOVIC ET AL.	
	Examiner	Art Unit	
	Ramnandan Singh	2644	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 November 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 November 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. Figures 1 and 2 should be designated each by a legend such as --Prior Art-- because only those which are old are illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

2. The abstract of the disclosure is objected to because it contains more than 150 words. Correction is required. See MPEP § 608.01(b).

3. The specification is objected to because of the following informalities:

i) On page 5, Paragraph [0013], the following equations are in error because subscripts are not therein. The correct equations are given below:

$e_k[m] = y_k[m] - x_k[m]*h_k[m]$; and

$h_{k+1}[n] = h_k[n] + \mu \cdot e_k[m] \cdot x_k[m-1]$

ii) On page 5, Paragraph [0013], the following references to Fig. 2 have not been made:

In Paragraph [0013], echo canceller circuit "**20**" and "error signal **"23"** are not referenced to Fig. 2.

In Paragraph [0020], far-end excitation "**24**" is not referenced to Fig. 2

Appropriate correction is required.

Claim Objections

4. Claim 13 is objected to because of the following informalities:

Claim 13 recites the limitation " said step size value is **increased"** in line 2. This is in error. Replace the term "**increased"** with the term "**decreased**". For the purpose of this Office action, the Examiner assumes "said step size value is **decreased".**

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 2, 4 and 16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 recites the limitation "the far end" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim 4 recites the limitation " **approximately 15 dB or greater**" in line 3. The term "**or greater**" is indefinite because this may have any value between 15 and infinity.

Claim 16 recites the limitation "audibly imperceptible to users" in lines 2-3. The term "audibly imperceptible" is indefinite because it is subjective and may assume any value.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1, 4-11, 13-15, 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zerguine et al [IEE Proc. –Vision and Image Signal Processing, Vol. 146, No. 4, August 1999] in view of Sievers et al [US 5,742,346] and further in view of Sih [US 5,687,229].

Regarding claim 1, Zerguine et al teach a method of converging an adaptive filter of a communication channel, comprising:

using a step size, μ_2, bounded between two limits, as shown in Equation (18) of Zerguine et al.

In order to establish a correspondence between the description of the reference and the description of the claimed matter of Applicant, the following simplification is in order:

Equation (18) of Zerguine et al can further be rewritten as:

$$\mu_2 = \frac{2\,\mu_{fixed}}{6\,N_2\,\sigma^2_x\,E[w^2(n)]}$$

where μ_{fixed} is a constant (i.e. nominal value of the step-size) with $\mu_{fixed} < 1$, to ensure that

$$\mu_2 < \frac{2}{6\,N_2\,\sigma^2_x\,E[w^2(n)]};$$

N_2 is the filter length in taps;

σ^2_x is the far-end power; and

$E[w^2(n)]$ is the noise power.

Expressing the above equation in a general form of the step-size function, we have the following equation:

$$\mu_2 = \frac{2\ \mu_{fixed}}{f_1(N_2)\ f_2(6p_x)\ f_3(E[w^2(n)])} \qquad (1)$$

Equation (1) shows that it contains multiplication and division which involve complex computational operations for determining a value of the step-size, μ_2 for a given sample. It may, however, noted that logarithms allow multiplication and division to be replaced by simpler operations of addition and subtraction, respectively. In addition, no details regarding initializing the above adaptive filter having a step-size and a penalty point value (i.e. **noise power**) are given which are essential for an operational echo canceller. So one of the ordinary skill in the art would have been motivated to seek any known method of initializing the above filter, such as Sih [US 5,687,229].

Zerguine et al do not teach expressly a method to initialize the filter as well as applying logarithms to simplify the computations operations.

Sievers et al disclose demonstrating the application of the logarithm (for example, base two) to facilitate performing mathematical operations on the energy values [col. 5, lines 14-28].

Sih teaches initializing both state filter 158 and echo canceller filter 160 [Fig. 5] using a state machine 180 at the start of operation by providing in the control input to the filter coefficient generator a step-size and penalty point values (i.e. **variable threshold parameters for noise power**) [col. 15, lines 38-59].

Zerguine et al, Sievers et al and Sih are analogous art because they are from a similar problem solving area, viz. , adaptive filtering.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art (i) to apply the base two logarithm as suggested by Sievers to facilitate performing mathematical operations on the step-size of Zerguine et al (as given in Equation (1) above), and thereby reducing computational complexity [Sievers et a; col. 5, lines 25-228]; and (ii) to perform the filter initialization using a step-size and noise threshold of Sih with Zerguine et al permitting a fast initial filter convergence [Zerguine et al; col. 15, line 48 to col. 16, line 7].

Thus, applying a base two logarithm to Equation (1) and assigning the result to a variable, m, (to represent it into an equivalent form), the following equation is obtained:

$$m = \log_2(\mu_2) = 1 + m_0 - L - P_x - N \qquad (2)$$

where $m_0 = \log_2(\mu_{fixed})$, $L = \log_2(f_1(N_2))$, $P_x = \log_2(f_2(6p_x))$, and $N = \log_2(f_3(E[w^2(n)]))$,

wherein the noise power, N, corresponds to **a penalty point value** to control the step-size of the filter. It may, however, be noted that Applicant selects a penalty point value **subjectively** based on experience, and applies this to control the effect of noise on the filter convergence [See Applicant's specification, page 8, lines 4-8], wherein Zerguine et al teach computing the **penalty point value** objectively and continuously.

In light of Equation (2) above, Zerguine et al teach combining a nominal step-size value (i.e. $\mathbf{m_0}$) and a penalty point value (i.e. **N**) to generate a step-size value ; and dynamically (i.e. **at sample n**) changing the step-size by adjusting the penalty point value (i.e. **computing N) .**

Claim 17 is essentially similar to claim 1, except for changing the step-size value by adjusting the nominal step-size value. Sih further teaches changing the step-size value by adjusting the nominal step-size value [Fig. 8].

Regarding claim 18, the combination of Zerguine et al, Sievers et al and Sih teaches selectively changing the step size value, m, by adjusting either the nominal step-size value, m_0; the penalty point value, N, or both the nominal step-size value, m_0, and the penalty point value, N [See Equation (2) above].

Regarding claim 4, Zerguine et al teach decreasing the step-size by adjusting the nominal step-size when an achieved combined loss is approximately 15 dB or greater (i.e. **ERLE is greater than 14 dB)** [Fig. 8; col. 15, line 52 to col. 16, line 7].

Regarding claim 5, the combination of Zerguine et al, Sievers et al and Sih teaches using various sets of step-sizes to achieve a faster convergence as shown in Figs. 8-9 [col. 24, lines 5-10]. Clearly, Equation (2) shows the following :

when the right-side term of Equation (2) is decreased; the step-size, m, is also decreased. However, the right-side term is decreased, when the penalty value point (i.e. ($E[w^2(n)]$, noise power), goes up. Therefore, it follows that the step-size, m, is decreased , when the penalty value point (i.e. **($E[w^2(n)]$, noise power**), goes up. This relationship between the step-size and the penalty value point holds for all the given operational conditions including the condition, $P_x < -45$ dBm_0. Hence, when the penalty value point (i.e. **($E[w^2(n)]$, noise power**), goes up, the step-size inherently meets all the conditions of claim 5.

Regarding claim 6, Zerguine et al teach decreasing the step-size value by adjusting the penalty point value. As shown above in claim 5, the step-size value is decreased, when a level of the channel's near-end background noise is high (i.e. **($E[w^2(n)]$, noise power goes up)**.

Regarding claim 7, the combination of Zerguine et al, Sievers et al and Sih further teaches decreasing the step-size by adjusting the penalty point value function, N, to avoid divergence when weak double-talk in the communication channel is detected (i.e. **when the short-term ERLE drops below some predetermined threshold such as 6 dB)** [Sih; col. 8, lines 27-46].

Regarding claim 8, Sih teaches resetting the step-size value, m, by adjusting the nominal step-size value, m_0, to avoid divergence [Sih; Fig. 8; col. 15, lines 48-54].

Regarding claims 9-11, although Sih teaches reinitializing (i.e. **updating)** the penalty point value (i.e. **N)** every 128 samples (i.e. **16 ms for a 8kH sampling rate**) [col. 17, lines 61-65], it would have been obvious to one of ordinary skill in the art at the time the invention was to update the penalty point value (i.e. **N)** of the filter for an intended use subject to circuit, system, and design constraints.

Claim 13 is essentially similar to claim 4 and is rejected for the reasons stated above.

Regarding claim 14, claim 14 recites the limitation "ρ has a positive **or** negative integer value" in line 6. For the purpose of this Office action, the Examiner assumes "ρ has a positive value. Zerguine et al teach a method wherein the step-size is expressed by equation (2) given above, and **the penalty point value, N**, (i.e. $\log_2(f_3(E[w^2(n)]))$ is automatically computed for every sample, wherein **the penalty point value, N**, is a positive quantity, and may have values including integers.

Regarding claim 15, Sih teach a method to detect a double-talk using a short-term echo return loss enhancement (ERLE) when the speech signal is at least 6 dB less than a far-end speech signal [col. 8, lines 27-46] and at least 12 dB above a noise floor [col. 16, lines 53-65].

9. Claims 2-3, 12, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Zerguine et al, Sievers et al and Sih [US 5,687,229] as applied to claims 1 and 10 above, and further in view of Sih [US 5,592,548].

For clarity of presentation, Sih [US 5,687,229] is designated as Sih-I, and Sih [US 5,592,548] as Sih-II.

Regarding claim 2, the combination of Zerguine et al, Sievers et al and Sih-I does not teach expressly detecting a tone originating from the far-end of the communication channel for decreasing the step-size by adjusting the penalty point value function.

Sih-II teaches detecting a tone causing the filter to converge quickly, and thereby, decreasing the adaptation step-size [col. 5, lines 25-33].

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to provide the tone detector of Sih-II with the combination of Zerguine et al, Sievers et al and Sih-I to detect a tone so that the step-size may be decreased by adjusting the penalty point value function, N, to allow adaptive filter to accurately track variations in an unknown echo channel [Sih-II; col. 5, lines 21-24].

Regarding claim 3, the combination of Zerguine et al, Sievers et al, Sih-I and Sih-II further teaches decreasing the step-size by adjusting the penalty point value function, N, when full convergence is achieved [Sih-II; col. 5, lines 18-24].

Claim 12 is essentially similar to claim 3 and is rejected for the reasons stated above.

Regarding claim 16, Sih-II further teaches achieving full convergence of the filter wherein further convergence (i.e. **using the same large adaptation step-size)** can cause the response of unknown adaptive filter to **overcompensate** for minor variations in unknown echo channels resulting in tracking audibly imperceptible signals (i.e. low noise) [col. 4, line 65 to col. 5, line 24].

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Arbel [US 4,912,758] teaches determining the value of a step-size [col. 5, line 23 to col. 7, line 12].

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ramnandan Singh whose telephone number is (703)308-6270. The examiner can normally be reached on M-F(8:00-4:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Forester Isen can be reached on (703)-305-4386. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ramnandan Singh
Examiner
Art Unit 2644